Results
from
1995-1996 SARE Pasture Quality Research
FNE95-113
Jim Weaver & J.Craig Williams

1995 Research:

Hypothesis:

The use of a refractometer to measure the content of the sugars in forage samples will allow a grazier to determine the quality of forage and make management decisions based on the sugar content. Most farmers are "geared" to think in terms of protein content. A correlation between protein and sugar concentration would establish the credibility of this low cost, portable, rugged instrument for field use.

Project methods:

Samples of forage were taken on a monthly bases at four farms in Tioga Co., Pa. The samples were tested for sugar (Brix) in the field immediately. Plant juices were squeezed from the sample with a modified vise grips. The samples were measured with an automatic temperature compensating refractometer on-site. The samples then were taken to the lab and analyzed for crude protein. Kjeldahl nitrogen/Nessler method for crude protein was used and correlated to the sugar content from the refractometer.

Results from 1995:

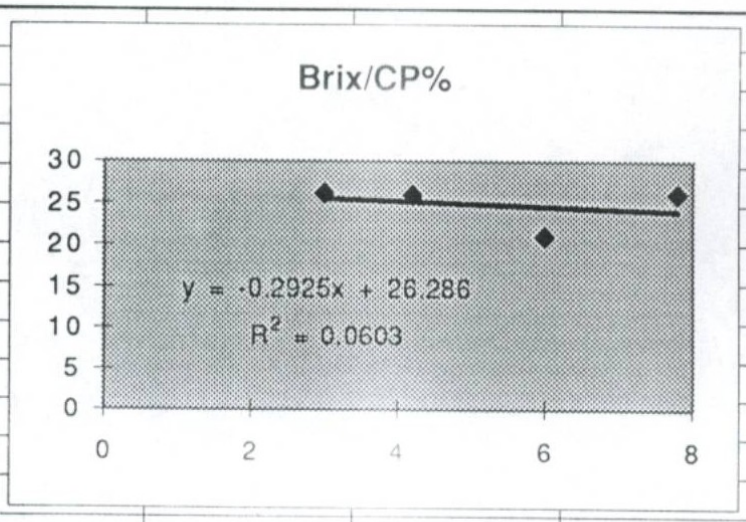
After a summer of collecting and analyzing pasture samples from four farms on a monthly bases it was determined that no correlation exists between crude protein and sugar content of pasture forage. Personal conversations with Dr. Dan Skow at Ag Labs, Inc., in Fairmont MN confirmed this result. The graph on the following page show the plotted crude protein vs. brix readings from the refractometer.

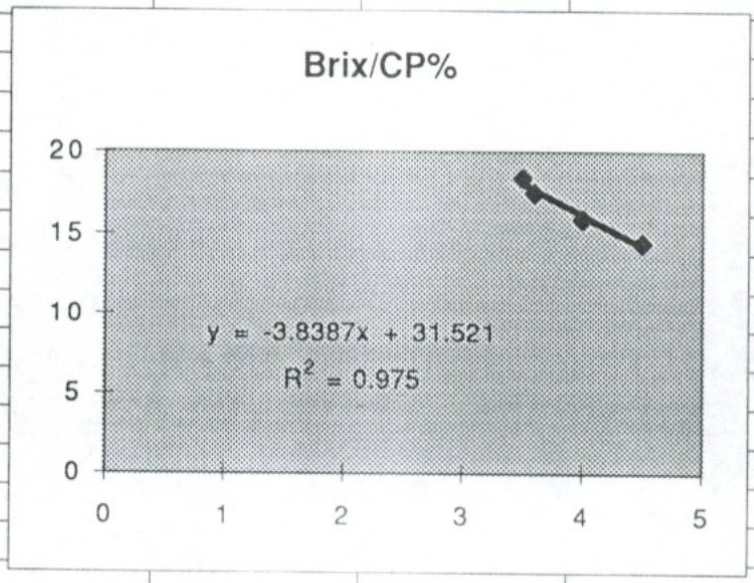
In the course of this research it also became apparent that while protein is a important component in the ration of pastured livestock, it is, in quality pastures in rotational grazing, usually not the limiting factor. The protein:energy ratio is a more realistic indicator of pasture quality. From this it was hypothesized that since sugar is a component of carbohydrates, a correlation with ADF would be possible and also more indicative of the overall "edibility" of a forage. In discussions with the local county agent we also thought it would be interesting, needed and easy to get calibrations for the various methods used to determine available dry matter in a paddock.

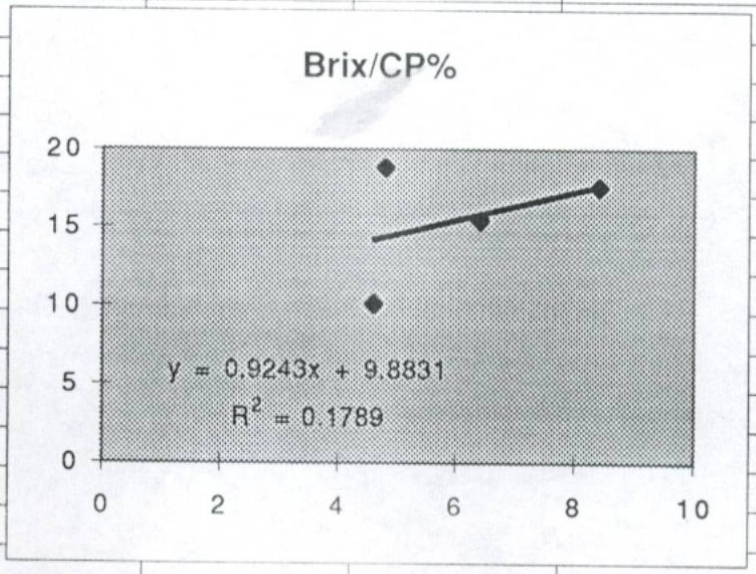
Quick Protein Research
SARE Grant #FNE95-113.
Final Report

Brix vs %Crude Protein

Quick Protein Data 1995	
5/1/95	
Brix	Crude Protein
3	26.1
7.8	26
6	21
4.2	25.9
5/31/96	
Brix	Crude Protein
4	15.9
4.5	14.4
3.5	18.4
3.6	17.5
7/3/95	
Brix	Crude Protien
8.4	17.6
4.8	18.8
6.4	15.4
4.6	10.1



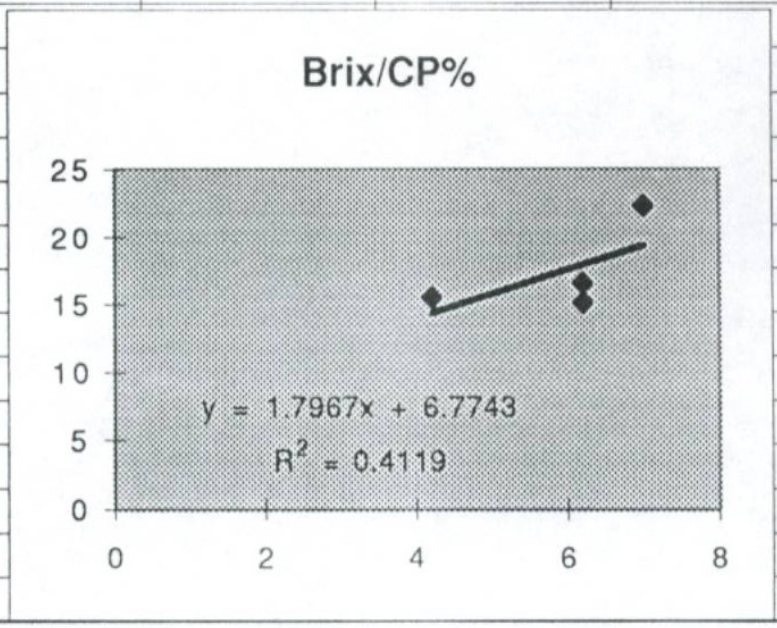




Quick Protein Research
SARE Grant #FNE95-113.
Final Report

Brix vs %Crude Protein

8/1/95	
Brix	Crude Protien
4.2	15.5
6.2	15.1
7	22.3
6.2	16.6



1996 Research:

An extension for the SARE Producer Grant was requested and received for 1996. The Tioga Co. Dairy Extension Agent and I spent the summer collecting and analyzing data from the same four Tioga Co. Farms; this time with the intent of correlating carbohydrate (fiber) with a brix reading from the refractomemter. We also included a procedure for collecting actual dry matter from each paddock sampled to calibrate our DM/Ac. measurements.

Hypothesis:

Since sugars are simple carbohydrates and can be measured with the refractometer, the correlation to energy should be possible.

Project Methods:

Samples of forage were taken on a monthly bases at four farms in Tioga Co., Pa. Ten one foot square samples were clipped with battery powered hedge clipper. Site were randomly selected by throwing a 24" 2x2 over the shoulder while walking the paddock. We attempted to select the paddock that would be grazed the next day in the rotation. All paddocks sampled were mixed grass/legume pastures and representative of the pastures on the farms of the northern tier of PA. During sampling a visual estimate of the paddock using the STAC method; plus rising plate meter, hand and height in inches where measured. The samples were tested for sugar (Brix) in the field immediately. Plant juices were squeezed from the sample with a modified vise grips. The samples were measured with an automatic temperature compensating refractometer on-site. The samples then were taken to the lab and analyzed for Acid Detergent Fiber.

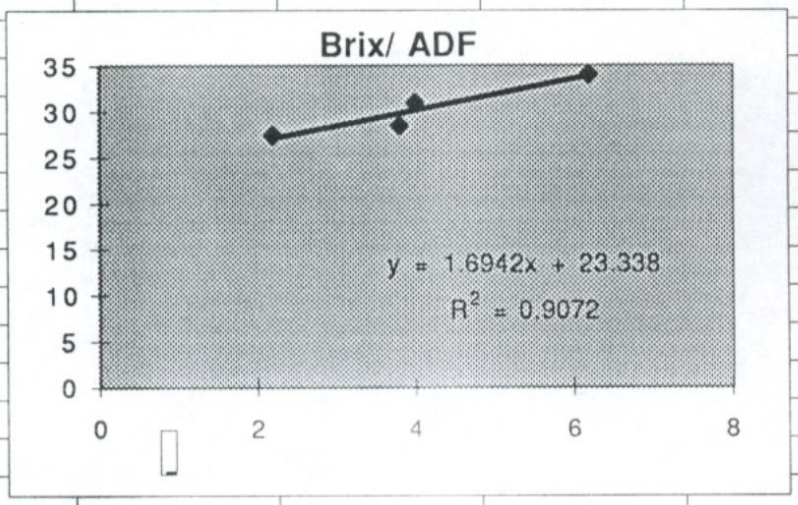
Results from 1996:

As the charts on the following page show, there was no correlation to ADF. Some attempt was made to look for a "quality" factor in the forage that we could use for correlation. It was determined, however, that the refractometer could only be used to measure the sugar content as a snapshot of pasture quality. The many variables: including time of day, species mix, fertility of the soil, rainfall, weather, all had an effect on the Brix readings taken. The rate and period of photosynthesis were probably the most important variables. Much more research will be needed to calibrate the refractometer to forage quality.

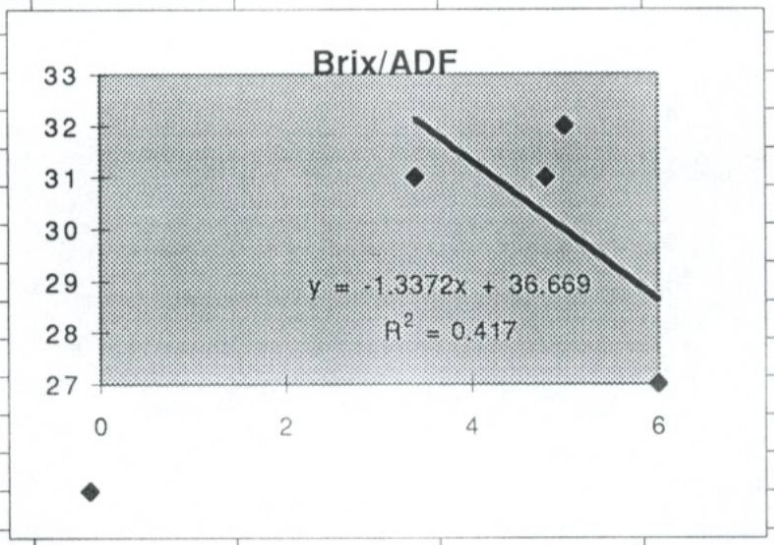
Brix vs Acid Detergent Fiber

Weaver Brix Pasture Data

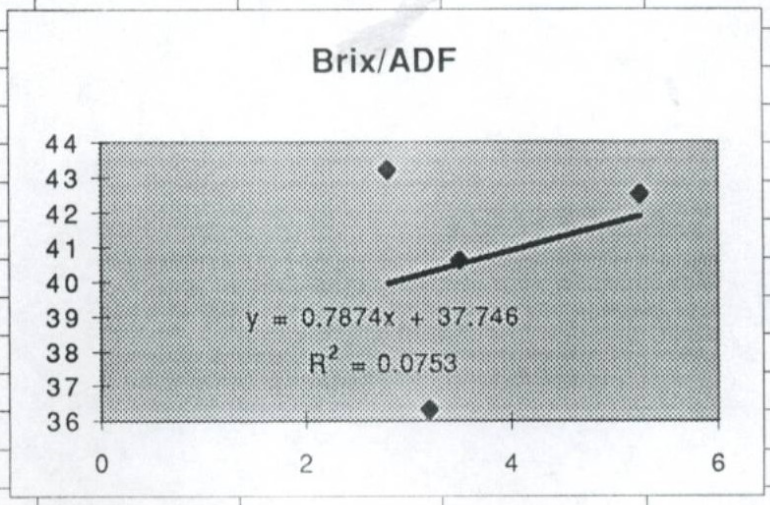
5/3/96	
BRIX	ADF
2.2	27.4
3.8	28.5
6.2	34
4	30.9



6/3/96	
BRIX	ADF
3.4	31
4.8	31
5	32
6	27



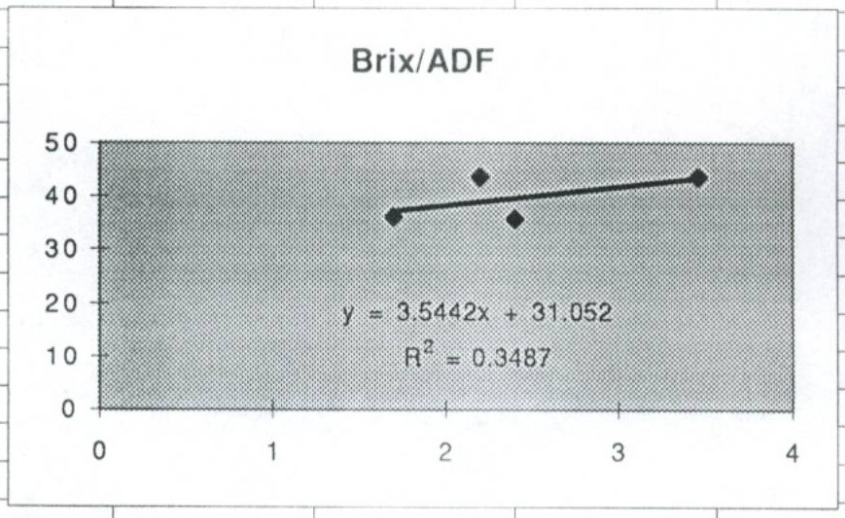
7/1/96	
BRIX	ADF
2.8	43.2
3.2	36.3
3.5	40.6
5.25	42.5



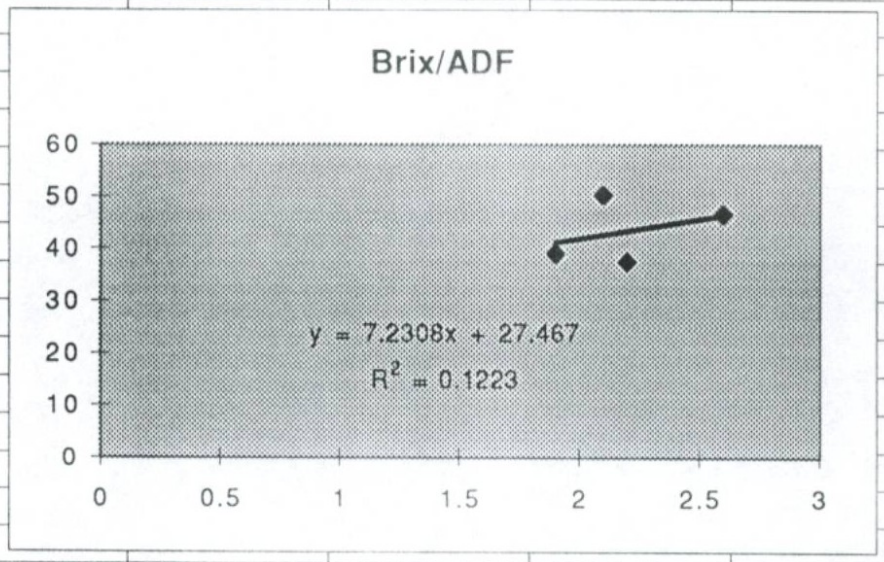
Quick Protein Research
SARE Grant #FNE95-113.
Final Report

Brix vs Acid Detergent Fiber

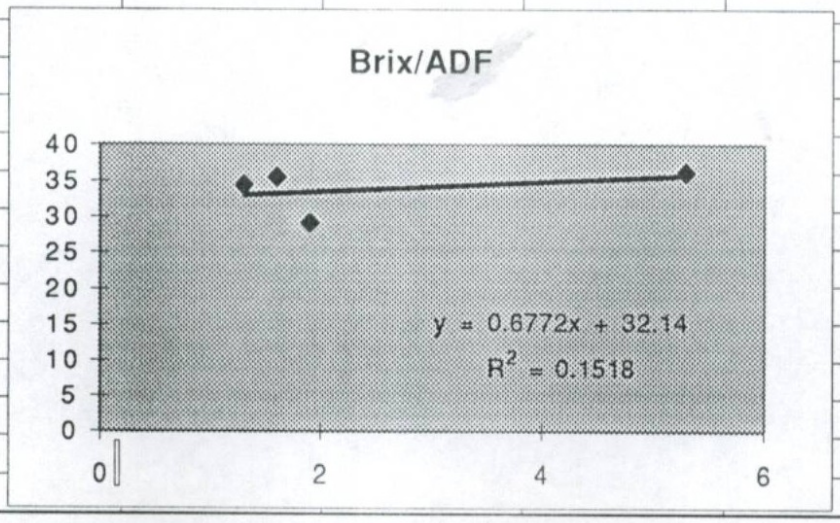
8/12/96	
BRIX	ADF
2.4	35.7
2.2	43.6
1.7	36
3.46	43.5



9/10/96	
BRIX	ADF
2.2	37.5
2.1	50.3
1.9	39.1
2.6	46.6



10/8/96	
BRIX	ADF
1.3	34.5
1.9	29.1
1.6	35.6
5.3	36.2



APPENDIX A
Pasture Clipping and Measurement Study 1996
Jim Weaver & J.Craig Williams

During the 1996 Pasture Protein Grant Research we also attempted to "calibrate the various methods for estimating Available Dry Matter in the field? Several methods were used to estimate the ADM in each paddock sampled. With the actual dry matter samples taken it was just a matter of comparing each method to actual values for each paddock.

Methods

Samples of forage were taken on a monthly bases at four farms in Tioga Co., Pa. Ten one foot square samples were clipped with battery powered hedge clipper. Site were randomly selected by throwing a 24" 2x2 over the shoulder while walking the paddock. We attempted to select the paddock that would be grazed the next day in the rotation. All paddocks sampled were mixed grass/legume pastures and representative of the pastures on the farms of the northern tier of PA. During sampling a visual estimate of the paddock using the STAC method; plus rising plate meter, hand and height in inches where measured.

STAC Method

The STAC method is a simple measurement of forage *available* using the height of the pasture in relation to where it come to on your leg. With S = Sole of boot = 300 lbs. of ADM (*Available Dry Matter*), T = Top of boot = 600 lbs. of ADM, A = Ankle = 900 lbs. of ADM, C = Calf = 1200 ADM. A rough estimate of forage available is then arrived at by how much of the paddock is at that height. This method does not take into account the density of the forage directly but must be averaged into the result by "eye". This method was chosen because it is easy to teach, simple to learn and always available to the grazier (doesn't require a tool or measuring devise).

Hand Method

Another always available method (but it does require bending over) that takes into account the density of the forage. One hand is placed –palm open – vertical on the ground, the other hand –palm open – horizontal along side the other hand. By pressing down with the horizontal hand until resistance is felt dry matter can be determined. Bottom two fingers = 1200 lbs. of dry matter. Top two fingers = 1800 lbs. of dry matter. Top of extended thumb = 2400 lbs.

Stick

This method requires the use of a yardstick. And simply measure the height of the forage in inches. Density is not factored into this measurement.

Rising Plate Meter

The Rising Plate Meter is a yardstick with a 18" square piece of .022" piece of plexiglass with an one & one half inch hole in the center suspended by 4 strings. The yardstick rides through the center hole. This method allows the density of the forage to be accounted for and included in the measurement. Every inch was 432 lbs. of total dry matter.

Results

Results of the measurement of the actual dry matter in each paddock was very useful for estimating, with the techniques most graziers use, available DM/Ac. As the following graphs show we consistently underestimated the available dry matter in each of the paddocks sampled. This is probably a good buffer to leave in place as it is possible to remove too much residual in close grazing situations and limit the swards ability to regrow after the graze period. This would cause increased rest periods to allow sufficient regrowth for subsequent rotations (untoward acceleration).

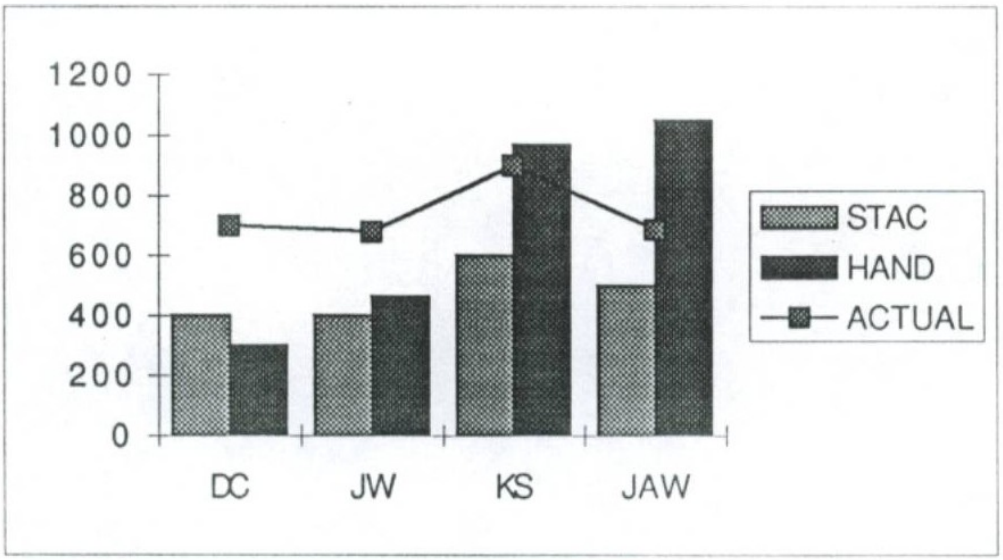
The primary result of this study is that it is not so much what a grazier uses to measure available dry matter as it is to calibrate the method used or work with someone that has calibrated the method and learn how to use it.

Tioga County, 1996 Pasture clipping and Measure study

Jim Weaver, J. Craig Williams

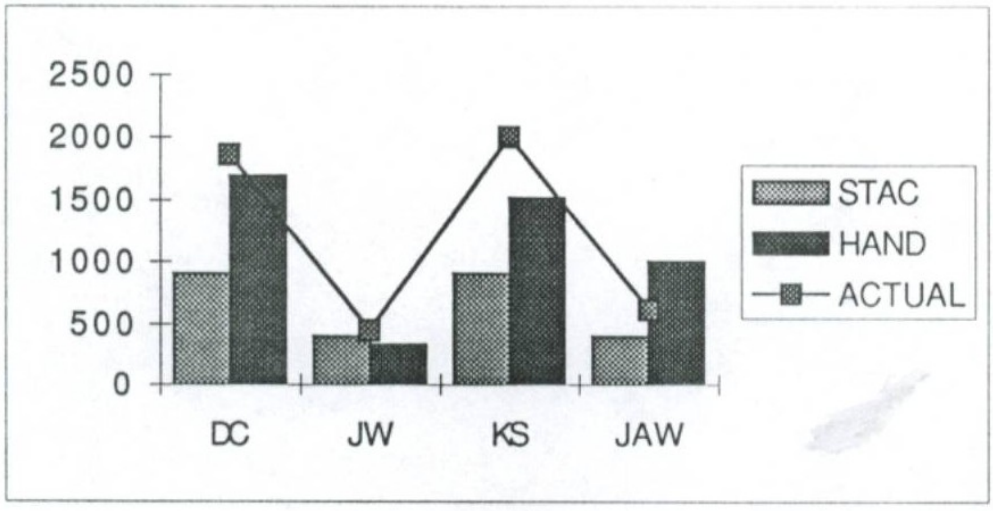
5/3/96

FARMER	STAC	HAND	ACTUAL	STICK	RP METER	BRIX	ADF
DC	400	300	701	3	2.5	2.2	27.4
JW	400	465	680	2.65	2.25	3.8	28.5
KS	600	970	902	2.4	2.7	6.2	34
JAW	500	1050	688	4	3.8	4	30.9



6/3/96

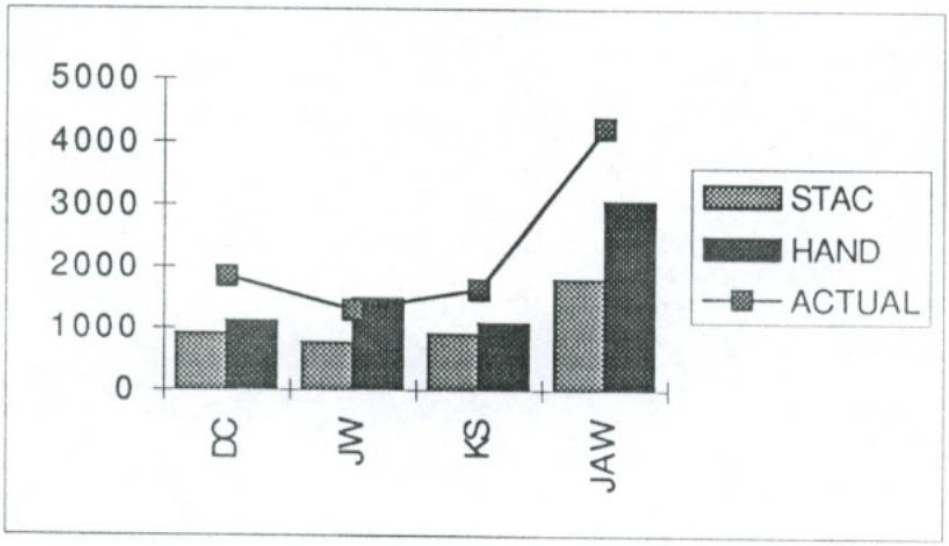
FARMER	STAC	HAND	ACTUAL	STICK	RP METER	BRIX	ADF
DC	900	1690	1863	5.5	5.5	3.4	31
JW	400	330	451	2	1.8	4.8	31
KS	900	1520	2001	5.7	4	5	32
JAW	400	1000	617	2.4	2.1	6	27



Tioga County, 1996 Pasture clipping and Measure study
Jim Weaver, J. Craig Williams

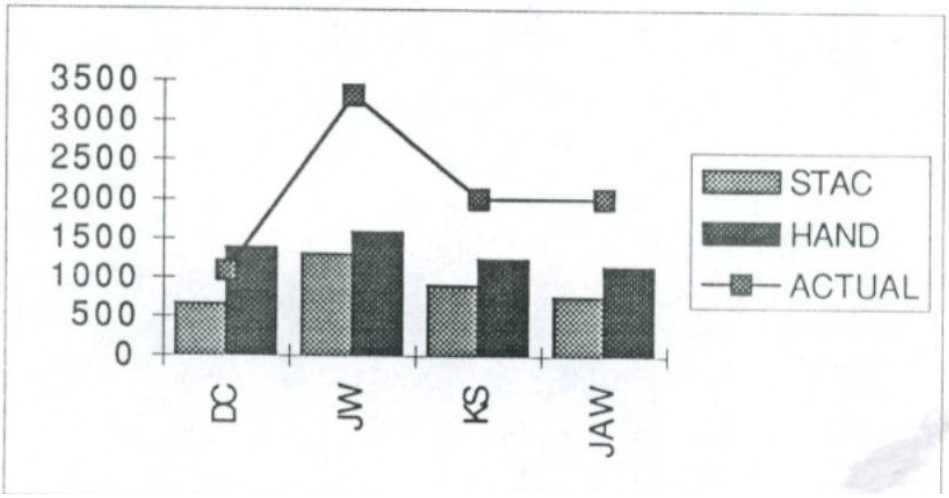
7/1/96

FARMER	STAC	HAND	ACTUAL	STICK	RP METER	BRIX	ADF	
DC	900	1120	1838	3.9	3.55	2.8	43.2	
JW	750	1480	1294	4.85	4.3	3.2	36.3	
KS	900	1090	1634	3.7	3.2	3.5	40.6	
JAW	1800	3040	4221	19.3	10.9	5.3	42.5	Hay field



8/12/96

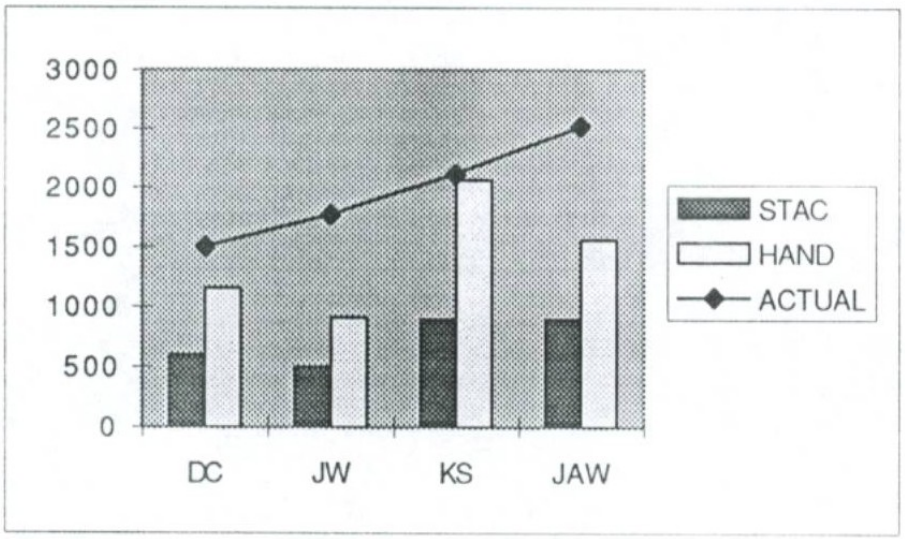
FARMER	STAC	HAND	ACTUAL	STICK	RP METER	BRIX	ADF	
DC	650	1380	1086	2.85		2.4	35.7	no RP meter
JW	1300	1590	3314	4.5		2.2	43.6	
KS	900	1240	2014	3.4		1.7	36	
JAW	750	1140	2010	3.5		3.5	43.5	



Tioga County, 1996 Pasture clipping and Measure study
Jim Weaver, J. Craig Williams

9/10/96

FARMER	STAC	HAND	ACTUAL	STICK	RP METER	BRIX	ADF
DC	600	1150	1497	0	2.9	2.2	37.5
JW	500	910	1770	0	3.4	2.1	50.3
KS	900	2060	2110	0	4.3	1.9	39.1
JAW	900	1560	2518	0	4.7	2.6	46.6



10/8/96

FARMER	STAC	HAND	ACTUAL	STICK	RP METER	BRIX	ADF
DC	1200	1160	1770	3.3	3.2	1.3	34.5
JW	700	1270	1620	3.8	4	1.9	29.1
KS	450	970	1730	3.5	2.8	1.6	35.6
JAW	1200	860	2178	4.2	4	5.3	36.2